Space Weather Technical Forecast

Issued on Friday, 19 April 2024 at 01:51 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Further M-flares likely and a slight chance of X-flares. Slight chance of G1/Minor Storm conditions day 2 (20 Apr) due to high speed stream from a negative coronal hole.

Solar Activity: Activity is currently Moderate, with largest flare an M2.2 event, which peaked at 18/0248 UTC from AR3638 in the southeast. Background flux remains at C-class levels. There are currently thirteen sunspot regions on the visible disc. AR3639 is now the largest region on the disc, with a small delta spot previously visible. AR3645 is only slightly smaller, and lies in a cluster of sunspots in the southeast quadrant that appear to be magnetically connected, enhancing complexity and susceptibility to significant flaring. Within this cluster of regions AR3643 and newly numbered AR3647 also have some magnetic complexity. The remaining regions appear generally stable with little or no change through the period.
Several CMEs have been observed from an area near AR3638 over the past 24 hours. Most of these of the CME's have been analysed, with weak glancing blows possible on 21 or 22 Apr. However, confidence is low regarding this. The most recent CME is yet to be analysed and has the potential for an Earth directed component.

Solar Wind / Geomagnetic Activity: Solar wind parameters were indicative of very minor CME influence late in the period. Solar winds as observed by ACE at L1 were mostly slow-ambient, but briefly reached slightly elevated levels. Density was initially at average levels, but gradually decreased to below average. The Interplanetary magnetic field (IMF) strength, Bt, was initially moderate, peaking at 10nT at 18/0023 UTC, but then quickly dropped to weak levels. The north-south component, Bz, was predominantly positive, and only occasionally fluctuated to become weakly negative. Phi angle was initially positive (away from the Sun) but changed to become negative (towards the Sun) through the morning. Resultant geomagnetic activity remained Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) observed at GOES-18 was at background. High energy electron flux (greater than 2MeV) observed at GOES-16 was predominantly at background levels, occasionally reaching moderate levels. The associated 24-hour fluence remained below Active (1e8 integrated flux) with a value of 1.3e6 integrated pfu observed at 18/2359 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate activity is forecast with isolated M-class flares expected and a slight chance of isolated X-class flares.

Solar Wind / Geomagnetic Activity: CMEs associated with streams of plasma originating from AR3638 in the southeast may give some weak transient features during days 3 and 4 (21st and 22nd), although confidence is low regarding this. Solar winds are currently at slightly elevated, but a recurrent coronal hole high-speed stream is expected to become geoeffective later tomorrow (20 Apr) likely increasing speeds to elevated levels, continuing into day 3 (21 Apr),

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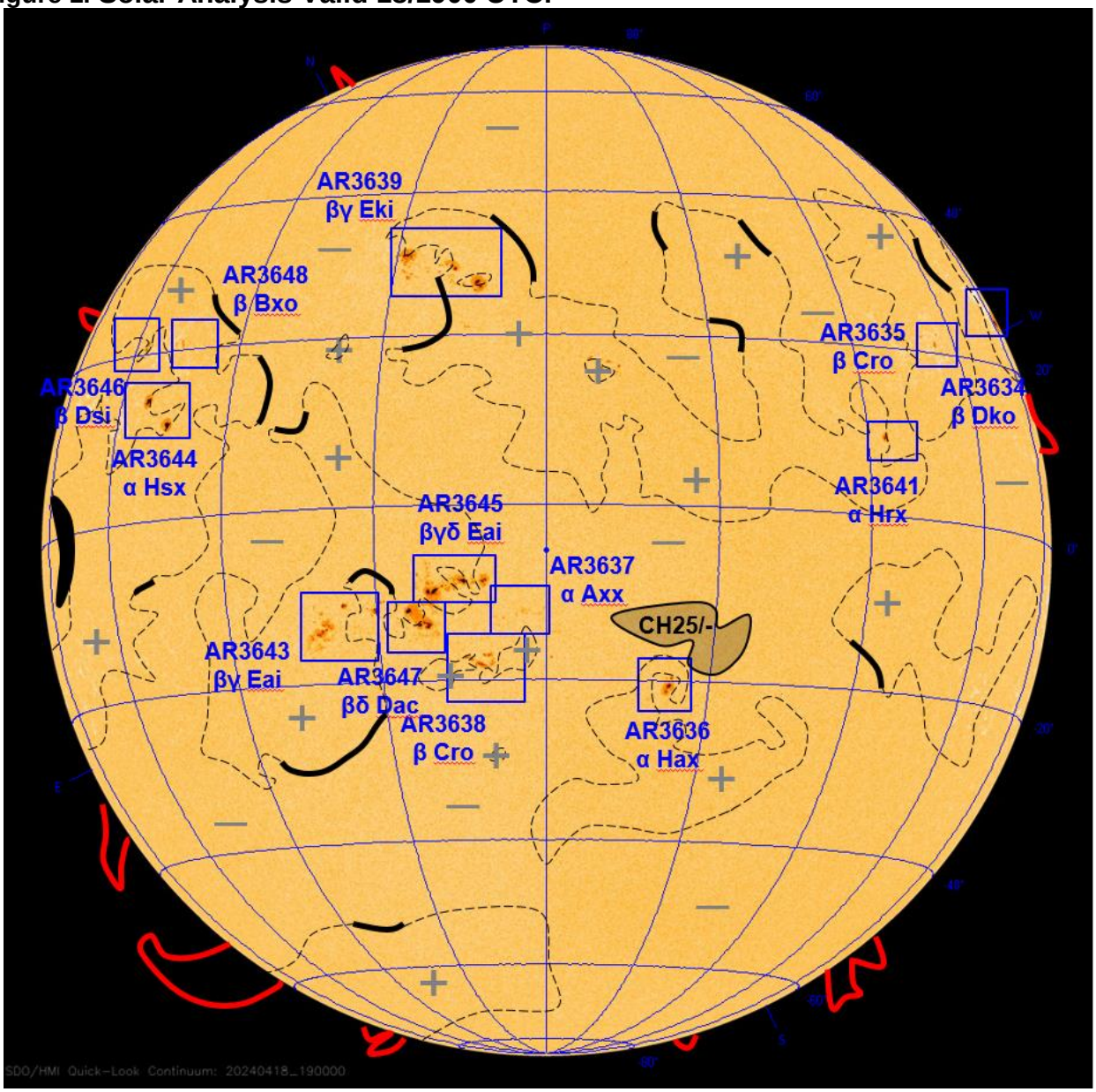
before gradually waning.

Geomagnetic activity is expected to be mostly Quiet to Unsettled (Kp 1-3). Activity may increase to occasional reach Active to G1/Minor Storm (Kp 4-5) levels tomorrow (20 Apr) due to the arrival of a HSS from CH25/-, and also possibly at times during days 3 and 4 (21st and 22nd) due to a chance of glancing blows from CME's.

Energetic Particles / Solar Radiation: High energy proton flux as observed by GOES-18 is forecasted to persist at background. High energy electron flux as observed by GOES-16 is expected to remain at background to moderate levels. The associated 24hr electron fluence is expected to remain below the Active (1e8 integrated pfu) threshold.

Figure 1. Solar Analysis Valid 18/1900 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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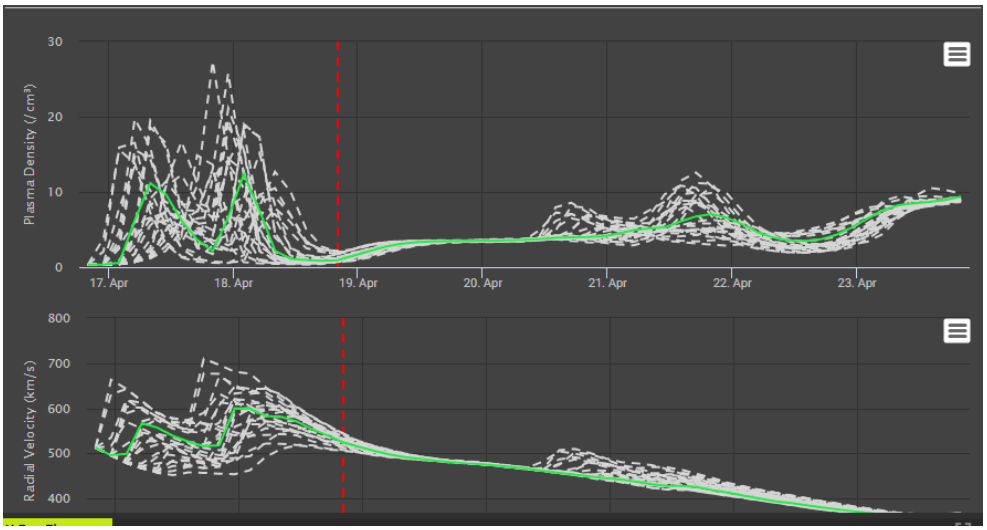
Geomagnetic Storms:

A CME that left the Sun following a flare and subsequent filament eruption, from the southeast disc near AR3636 on 15 Apr, may have arrived as a very weak feature late on the 18th.
Several CMEs have been observed from an area near AR3638 over the previous 24 hours. Most of these of the CME's have been analysed, with weak glancing blows possible on 21 or 22 Apr. However, confidence is low regarding this. More recent CMEs are yet to be analysed, and have the potential for some Earth directed components.

Coronal hole 25 is expected to become geoeffective later tomorrow (20 Apr). This is a persistent feature and gave peak speeds of around 550km/s on the previous rotation. The coronal hole itself appears smaller than on the previous rotation, though its equivalent position on the disc remains similar, so persistence forecasting for the onset carries moderately-high confidence, though likely with lower peak speeds than seen in March, estimated to be around 450-500km/s. This feature is not adequately modelled by Enlil presently.
Geomagnetic activity is expected to be at mostly Quiet to Unsettled. Activity may increase to occasional reach Active to G1/Minor Storm levels tomorrow (20 Apr) due to the arrival of a HSS from CH25/-, and also possibly at times during days 3 and 4 (21st and 22nd) due to a chance of glancing blows from CME's.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	**G1 to G2**	No	10	20	20	20
Strong	**G3**	No	1	1	1	1
Severe	**G4**	No	1	1	1	1
Extreme	**G5**	No	1	1	1	1

Figure 2: MOSWOC Enlil ensembles showing possible weak glancing blows on the 21st and 22nd.



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Met Office Space Weather Technical Forecast

Radio Blackouts - X-Ray Flares:

There are currently thirteen sunspot regions on the visible disc, as AR3633 has now rotated behind the west limb. AR3639 remains the largest region on the disc with a weak delta spot, although AR3645 is not much smaller having slightly developed in area recently. AR3645 is in the southeast, close to newly numbered AR3647, with both regions magnetically complex with delta spots. AR3645 has also shown movement of spots within the region. AR3643, AR3645, AR3647 all appear to be magnetically connected, enhancing complexity and susceptibility to significant flaring. AR3634 near the western limb will be rotating off the disc in the next 6 hours. The remaining regions appear generally stable with only slight changes.

Moderate activity is forecast with isolated M-class flares expected and a slight chance of isolated X-class flares. AR3639 and the combination of AR3643, AR3645 and AR3647 are the most likely to produce significant flares. As all of these regions are currently in the eastern hemisphere, and not close to rotating off the visible disc, so the forecast probabilities remain constant throughout. Also, no new significant regions are expected to rotate onto the visible disc.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	75	75	75	75
Very Active	R3 to R5 X Class	No	15	15	15	15

Solar Radiation Storms - (High Energy Protons):

High energy proton flux as observed by GOES-18 has persisted at background levels and is expected to generally remain so. There is a slight chance of the observed flux increasing in response to any notable flares. This is initially due to AR3634, currently located on the western limb. Then the regions most likely to produce proton rich flares will gradually rotate west, reaching more favourable positions for proton rich flares to be observed at GEO.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	10	10	15
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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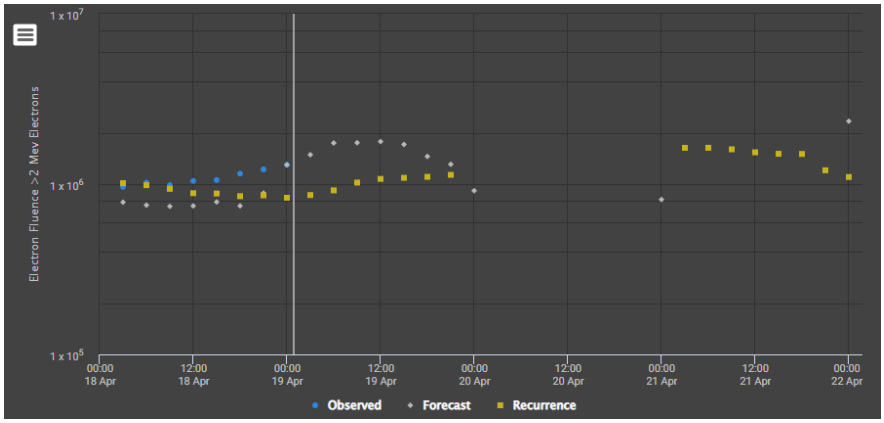
High Energy Electrons Event (≥ 2MeV):

High energy electron flux as observed by GOES-16 is expected to remain at background to moderate levels with enhanced geomagnetic activity expected to generally suppress values in the coming days.
The associated 24hr electron fluence is expected to remain well below the Active (1e8 integrated pfu) threshold, with current REFM output accepted as good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: MOSWOC REFM model.



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